CLAIMS

I claim:

1. A single-chip radio for bidirectional wireless communications, comprising:

a bulk semiconducting substrate, and

at least one integrated antenna, at least one transceiver, baseband circuitry, and at least one filter integrally formed in or on said substrate.

2. The single-chip radio of claim 1, wherein said radio further comprises at least one on-chip battery.

3. The single-chip radio of claim 1, further comprising a battery for powering said radio, wherein said battery is a rechargeable battery.

4. The single-chip radio of claim 1, further comprising at least one on-chip sensor.

5. The single-chip radio of claim 4, wherein said sensor comprises a MEMS sensor.

6. The single-chip radio of claim 1, further comprising a package fully encapsulating said radio to form a packaged radio.

7. The single-chip radio of claim 6, wherein said packaged radio is configured as a high numbered hedron.

8. The single-chip radio of claim 1, wherein a weight distribution of said radio favors said radio landing face up when dropped in a random orientation.

9. The single-chip radio of claim 1, wherein said radio further comprises a non-volatile memory, said non-volatile memory integrally formed in or on said substrate.

10. The single-chip radio of claim 1, further comprising at least one voltage controlled oscillator (VCO), synthesizer, low noise amplifier, power amplifier, mixer, microprocessor, baseband signal processor, A/D and D/A converter integrally formed in or on said substrate.

11. The single-chip radio of claim 10, wherein at least one of said filter and said VCO comprises at least one varactor, wherein said varactor including a gate oxide thickness provided to high voltage input/output transistor structures on said substrate and a geometry provided to logic devices on said substrate.

12. The single-chip radio of claim 1, wherein a bulk resistivity of said substrate is at least 20 ohm-cm.

13. The single-chip radio of claim 1, wherein said at least one antenna comprises at least one transmit antenna and at least one separate receive antenna.

14. The single-chip radio of claim 13, wherein said transmit antenna provides an impedance less than 50 ohms and said receive antenna provides an impedance more than 50 ohms.

15. The single-chip radio of claim 1, further comprising at least one low-loss layer disposed beneath said substrate, said low-loss layer providing a thermal conductivity of at least 35 W/m•K and electrical resistivity greater than 100 ohm-cm.

16. The single-chip radio of claim 1, further comprising a passivation layer coating on said integrated antenna, said transceiver, said baseband circuitry, and said filter, said passivation layer having a dielectric constant of at least 20.

17. The single chip radio of claim 1, further comprising a microcontroller.

18. The single-chip radio of claim 1, wherein a thickness of said substrate is less than 250 μm.

19. The single-chip radio of claim 1, wherein a thickness of said substrate is less than 50 μm.

20. The single chip radio of claim 1, wherein said integrated antenna comprises an array of said integrated antennas for receiving signals and array processor for beamforming said

receive signals and an array of said integrated antennas for transmitting signals and an array processor for beamforming said transmitted signals.

21. The single chip radio of claim 1, further comprising an upconverter, said upconverter frequency translating signals to be transmitted to at least 10 GHz.

22. The single chip radio of claim 1, wherein said antenna is placed within 2 mm of an edge of said substrate.

23. The single chip radio of claim 1, wherein said antenna is a balanced antenna.